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(54) Reinforced door panels and method of producing same

(57) A reinforced door or door panel is provided of sandwich construction comprising two outer single or multi ply layers 3, 4 with a layer of rigid foam 5, preferably polyurethane foam, sandwiched therebetween. To provide security against break-in a metal grid 6 is embedded in the polyurethane foam. The door or panel may be made in two halves stuck together with a layer of adhesive 7, or the polyurethane can be injection moulded between the two outer layers with the reinforcing grid in place.

Fig.2

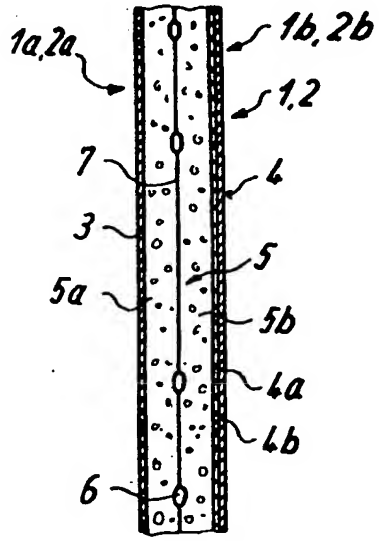

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Fig. 1

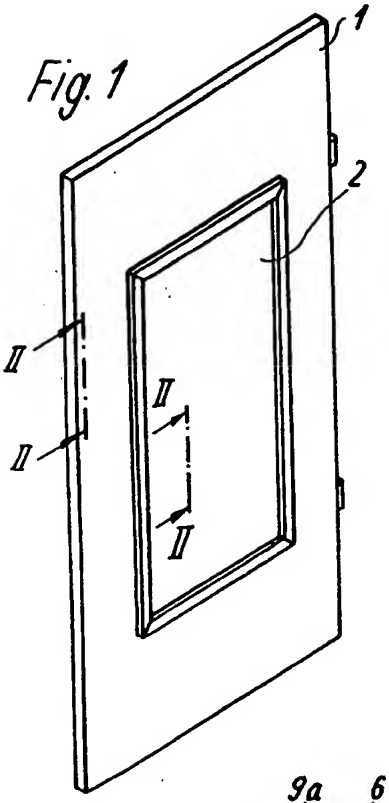
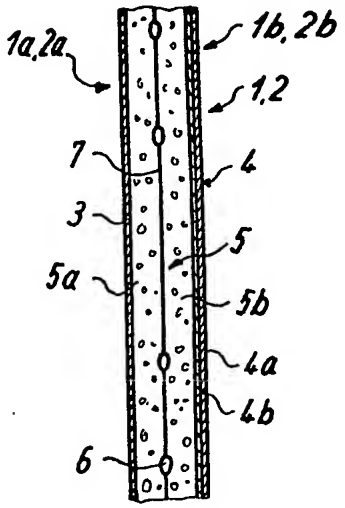


Fig. 2



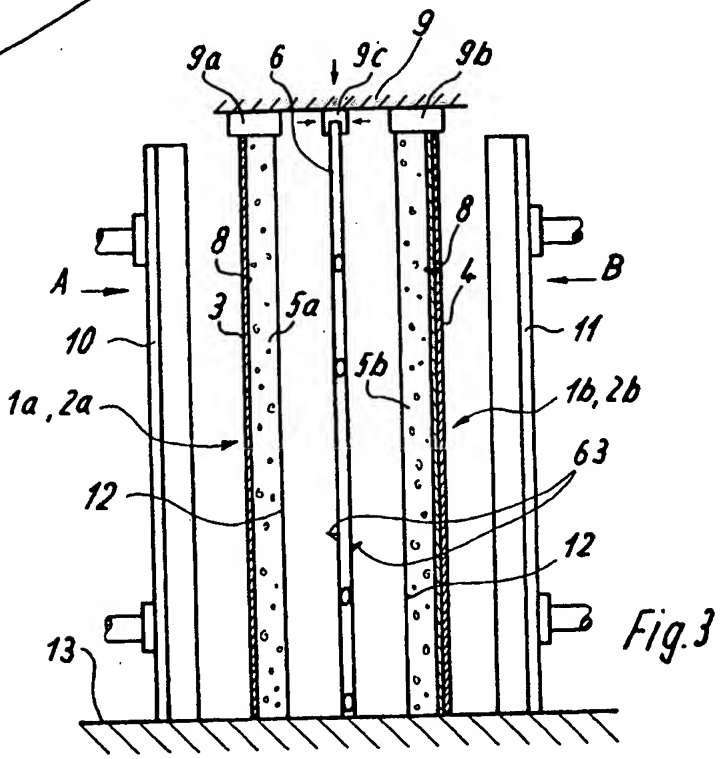


Fig. 3

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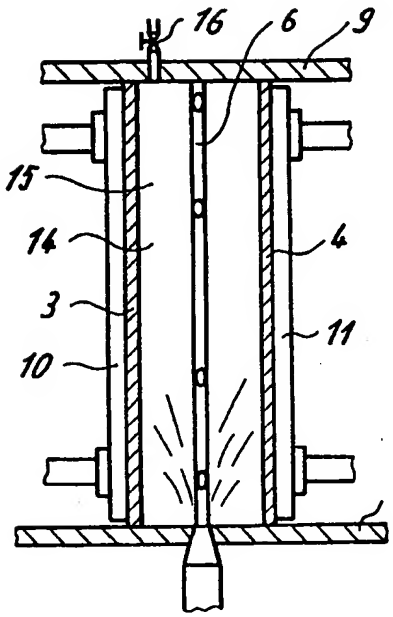

Fig. 4

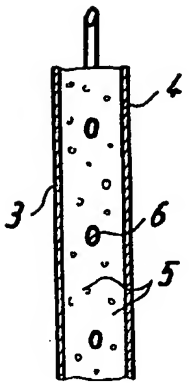

Fig. 6

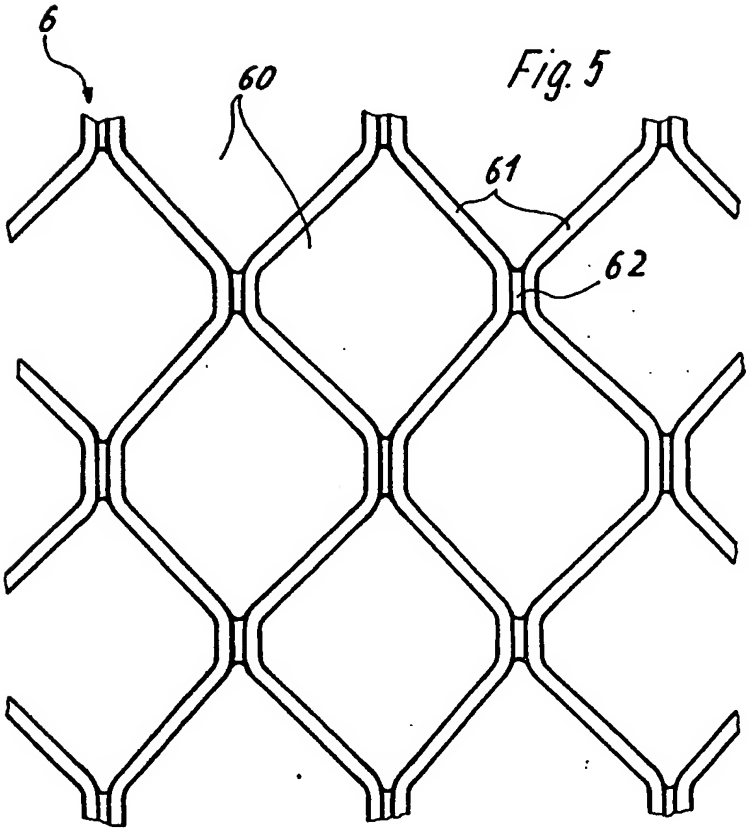

Fig. 5

SPECIFICATION

Reinforced door panels and the like and method of producing same

The invention relates to reinforced panels suitable for use as security doors, door panels and the like, and to a method of producing them.

Doors and door panels having a sandwich construction and constituting essentially a layer of rigid foam sandwiched between two outer layers are well known. These sandwich constructions generally fulfil the purpose for which they are intended, but do not as yet provide the generally necessary safeguards against anyone breaking in. From year to year, the need for personal safety becomes ever greater due to the increasing incidence of individual crimes such as breaking and entering, burglary, theft, rape and murder.

Consequently, there is a need to provide a reinforced panel construction which will be resistant to attempted break-ins but in which the protective measure is not externally visible, thus permitting the door or door panel to be designed at will, with the possibility of substantially retaining the already known sandwich-type construction and of producing the parts without any substantial additional cost in terms of working stages.

According to the invention, there is provided a reinforced panel suitable for use as a door, door panel or the like, said panel having a sandwich construction comprising an inner layer of rigid foam sandwiched between two outer layers, which outer layers may be of single ply or multi ply construction, wherein said panel is reinforced by a grid of reinforcing material embedded in said layer of rigid foam.

Preferably the grid is of metal and corresponds substantially to the surface dimensions of the sandwich panel in which it is embedded.

Other suitabie materials for the grid are glass fibres, aramide fibres, carbon fibres and synthetic reinforcing plastics material. Metal has the advantage of being easier to handle and of offering better stability for relatively low cost.

In one method of producing such a panel, two half panels are initially produced consisting of a close pore layer of rigid foam applied to the back one of two surface layers by means of an ahdesive or by means of liquid polyester, after which one or preferably both layers of rigid foam of the half panels is or are coated with adhesive such as liquid polyester or the like. Thereafter at least one grid, preferably a metal grid, is placed between the mutualliy facing rigid foam layers of the half panels and these latter are pressed together under a high pressure and in such a way as to enclose the grid, the grid or grids being evenly forced into the layers of rigid foam during the pressing operation, the layer(s) of adhesive joining the grid or grids directly together with the layers of rigid foam, and the layers of rigid foam themselves in the aperture filled areas of the grid or grids.

In an alternative method such panels are produced by placing two surface layers at a fixed distance from each other, the space between them being bound laterally all round by seals, placing at least one preferably flat grid Into that space, and injecting a preferably rigid polyurethane foam under high pressure in order completely to fill in the intervening space.

By virtue of the invention, it is now possible to meet the needs for safety which are prevalent among the people of today without outwardly altering the door leaf, door filling or continuous panel or the like, so that there is a high degree of protection against anyone breaking in. The door cannot be broken down either, even with very heavy tools, since the protective grid held within the sandwich panel will only yield partially, so that a burglar cannot make any access hole which is large enough without considerable effort. On the other hand, though, it is possible, either by providing several partial grids or by providing a smallish cut-out in the metal grid at the outset, for example, to cut a decorative aperture in the door leaf which can then be sealed off with reinforced glass. Thus, the end user can express his aesthetic wishes in the same way as the most widely diverse patterns of such doors can be marketed. In this respect, the reinforced glass cut-outs can be larger than peep-hole cut-outs, for example. What is really essential is that the door should not lose its character by having protective grids or the like bolted on it from outside. If desired, a decorative grid or even additional protective grids can, of course, be fixed on the door leaf or the door filling. However, any surface mounted grids have the disadvantage that the screws or bolts can be undone, although the burglar is then in the present circumstances surprised to find that even after the grid has been removed from the door, the latter still constitutes a real obstacle to a break-in.

Where the object of the invention is concerned, the simple manner of construction represents hardly any substantial extra cost over that of producing conventional door leaves or door panels, since there are relatively few additional working stages and it is necessary only to absorb the extra cost of the metal grid in comparison with standard sandwich doors or the like.

The parameters indicated can be varied. The pressure at which the panels are moved towards each other can be varied, in exactly the same way as the high pressure at which the foam is blown into the intervening space can likewise be varied, and may be between 6 and 12 bars.

Examples of the invention are shown in the

accompanying drawings, in which:

Figure 1 is a perspective view of a door according to the invention wih an inset door filling;

Figure 2 is a section through the door taken on either of the lines II-II of Figure 1;

Figure 3 shows in principle an apparatus for carrying out the compression process, employing two half panels;

Figure 4 shows an apparatus for carrying out the alternative method of injecting the rigid foam into the panel;

Figure 5 shows an embodiment of a metal grid suitable for use in the invention;

Figure 6 shows a section through a door made using the apparatus of Figure 4.

Figure 1 shows a door 1 in the middle portion of which a base panel is shown as a door filling 2. The construction of the door and of the door filling may be the same or similar. Sections on the lines II-II are shown in Figure 2, the section in the door and the door filling being similar. The surface and outer layers 3 and 4 of the door may be of different construction, particularly if the door or the like is to be installed as an externai door. In the embodiment shown the surface layer 3 may, for example, consist of a polyester layer, while the surface layer 4 in turn comprises two layers, e.g. a polyester layer 4a and an inner glass fibre layer 4b. Between these two layers 3 and 4 there is a rigid polyurethane foam layer 5 in which a metal grid 6 is embedded which corresponds at least partialiy to the overall dimensions of the door leaf. It can be seen in Figure 2 that the rigid polyurethane foam layer is centrally divided, 5a, 5b, each half being associated with one of the surface layers 3, 4 so that when the metal grid 6 is as yet not incorporated, there are two half panels 1a, 2a, 1b, 2b with a separation line constituted by one or two layers 7 of adhesive. The way in which this line of separation is created will be described later.

Constructed in this way, a panel when complete can be used as an entire door leaf or as a door filling or also for a facing panel. What is essential is the metal grid 6 in the interior of the sandwich panel.

It is possible for the metal grid 6 to extend over the entire door leaf 1, but it is also possible for the marginal zones of the door leaf 1 to be occupied for the most part by a metal grid 6 and for this to be incorporated into the sandwich. And yet a further possibility is additionally for the door filling 2 to be so constructed, or for the door filling 2 to be fitted with reinforced glass, to serve as a light-transmissive cut-out.

The size and disposition of the grid 6 is therefore variable. Preferably, however, they correspond substantially to the surface dimensions of the panel in order to provide effective protection. There is not much point in providing the metal grid 6 which is to serve as a protection if it is only provided in small areas.

Also the surface materials or surface layers can be varied according to choice so that the rigid polyurethane foam can be caused to adhere to different surface layers by using an adhesive or a binder. For example, the surface layers can be of wood, synthetic plastics or metal, or in the case of expensive doors, copper, or a combination of such materials.

If smooth doors 1 are used, then it is possible by forming see-though cut-outs in the door, to vary the outward design of the door, in which case the cut-outs ought preferably to be glazed with reinforced glass. In order to be able to provide any shape, size and type of cut-out in the door leaf 1, it is advantageous to make the grid 6 from material, for example aluminium, which can be sawn and cut. If this is not desired, then the grid may also be a steel grid or the like. What is esential is that the layers of foam or the embedded layer adhere to the grid.

The grid can therefore have whatever cut-outs are required so that it permits a satisfactory transition from one side to the other of the door leaf cross-section or the like.

Prefarably a rigid polyurethane foam layer is used as the middle layer and this, as already mentioned, may possibly be divided into two half panels which are glued onto the surface layers 3 and 4. The glue must establish a connection between metal, foam and polyester, according to where it is used. Preferably a liquid polyester will be used as the glue but other glues are suitable.

Figure 3 diagrammatically shows one method of producing a panel according to Figure 2.

As the drawing shows, a suitable glue 8, e.g. a liquid polyester, is applied to the surface panels 3 and 4 in order to bond thereto the rigid polyurethane foam layers 5a and 5b, the thickness of which will, of course, be half the desired thickness of the finished layer 5. A reciprocating holder 9 supports these half panels 1a, 2a or 1b, 2b, the support being so constructed that the clamping parts 9a and 9b of the support are able to move in the direction indicated by the arrow. The apparatus has on the outside pressing jaws 10 and 11, the force needed to achieve the pressure not being shown. By moving the pressing jaws together in the directions indicated by the arrows A and B, the half panels are carried towards the grid 6 which is located between them and supported by part 9c as Figure 3 shows. As a result the grid is embedded into the rigid polyurethane foam layers. Prior to bringing the layers together the inside surfaces of the rigid polyurethane foam layers 5a and 5b are coated with a layer 12 of ahdesive, e.g. a liquid polyester. This glue bonds the grid 6 to the polyurethane layers as well as bonding the foam layers themselves together through the holes in the grid 6. Thus the foam

layers 5a and 5b are connectd securely to each other, and by reason of the fact that very high pressure is applied, the grid is forced evenly into the foam iayers. An evenly structured composite panel is thus created. It goes without saying that the pressure is applied evenly from right and left in the directions indicated by the arrows A and B. The manner in which the force of pressure is applied for the pressing jaws 10, 11 has nothing to do with the object of the present invention and may be achieved in any known manner. What is essential is the regular mutual approach capability, the bottom part 13 of the apparatus guaranteeing that the two sides move together steadily.

Figure 3 shows only one example of such an apparatus. An alternative method of production is shown in Figure 4. In this case, the two surface layers 3, 4 are piaced at a fixed distance from each other with the grid 6 positioned therebetween. In order to inject the layer of polyurethane foam, the space 14 in the centre of the apparatus is sealed not only at the bottom by the support 13 and at the top by a support 9, but also by side walls 15. Also movable pressing jaws 10 and 11 are provided to apply pressure to the panel during and after injection. As indicated, polyurethane foam is injected under high pressure in between the surface layers 3, 4 in order to completely fill the intervening space. To allow the air to escape during the injection process, it is possible to provide a valve 16 in the support 9.

Figure 6 shows a cross-section through a panel produced using the method and apparatus according to Figure 4.

Figure 5 shows a suitable form of grid. In this case the grid is of aluminium, but it may be of a different metal. Large apertures 60 are left between the webs 61 of the grid. The individual webs, which extend in a zig-zag fashion, interconnect with adjacent webs, via bridges 62.

As can be seen from the foregoing, the concept of the invention is not restricted to the embodiments illustrated. Also the details of materials, for example polyurethane foam, which is extremely advantageous, particularly if closed pore rigid foam is used, must not be understood as being absolutely restrictive, because if necessary other foams are suitable for the purpose.

The flat grid 6 shown has advantages where the embedding process is concerned. It is however also possible for the grid 6 to be provided on the right andtor left of the flat surface with projecting members which then act like anchors. Two such projecting members 63 which may be given any desired shape, are shown in Figure 3.

In the method of Figure 4, it is preferable to inject a two component foam such as liquid polyurethane foam, the components only reacting fully with each other in the space 14. This can take place when heat is supplied, although this is not absolutely essential. Such a two component polyurethane rigid foam may, for example, have a polyol component to which a propellant, e.g. isocyanate, is added. These rigid polyurethane foams generally comprise at least two components. There are also rigid polyurethane foams which have more than two components. According to the effect which is to be acheived, for example, flow flammability and the like, different foams can be used.

CLAIMS

1. A reinforced panel suitable for use as a door, door panel or the like, said panel having a sandwich construction comprising an inner layer of rigid foam sandwiched between two outer layers, which outer layers may be of single ply or multi ply construction, wherein said panel is reinforced by a grid of reinforcing material embedded in said layer of rigid foam.

2. A reinforced panel according to claim 1, wherein said grid is a metal grid.

3. A reinforced panel according to claim 2, wherein said grid is of aluminium or steel.

4. A reinforced panel according to claim 1, wherein said grid is of glass fibres, aramide fibres or carbon fibres.

5. A reinforced panel according to claim 1, wherein said grid is of a synthetic plastics reinforcing material.

6. A reinforced panel according to any one of claims 1-5, wherein said grid is planar and is located centrally in said rigid foam layer in parallel with the plane of the panel.

7. A reinforced panel according to any one of claims 1-6, wherein the rigid foam is a rigid polyurethane.

8. A reinforced panel according to claim 7, wherein the rigid polyurethane is a two-component polyurethane foam.

9. A reinforced panel according to any one of claims 1-8, wherein the rigid foam layer is formed in two halves adhesively bonded to the opposite sides of the grid, which is embedded into the opposed surfaces of said two halves, and said two halves being adhesively bonded one to the other through the apertures of the grid.

10. A reinforced panel according to claim 9, wherein the rigid foam layers are adhesively bonded one to the other, and to the grid, with a polyester adhesive.

11. A reinforced panel according to any one of claims 1-8, wherein the layer of rigid foam is a single layer injection moulded around the grid and between the outer layers.

12. A reinforced panel according to any one of claims 1-11, wherein the outer layers consist of one or more plies of wood, metal or plastics material, or combinations thereof.

13. A reinforced panel according to any one of claims 1-12, wherein the grid is substan-

tially coextensive with the panel.

14. A reinforced panel according to any one of claims 1-12, which has one or more openings therein glazed with reinforced glass, and the grid is substantially coextensive with the frame of the panel bounding said opening(s).

15. A reinforced panel according to claim 1, constructed substantially as hereinbefore described with reference to the accompanying drawings.

16. A reinforced door consisting of a single panel according to any one of claims 1-15.

17. A method of constructing a reinforced panel according to claim 9 or 10, which comrpises producing two half panels, each comprising one of said outer layers ahdesively bonded to one of said half layers, applying adhesive to the exposed faces of said two half layers, placing the reinforcing grid between the adhesively coated half layers, and pressing the two half panels together with sufficient pressure to press the grid into the adhesively coated surfaces of said half layers to effect an adhesive bond between the two half layers and the grid, and between the two half layers themselves through the apertures in the grid.

18. A method of constructing a reinforced panel according to claim 11, which comprises placing the two outer layers in a mould on either side of and spaced from the reinforcing grid, and injecting the foam into the space between the two outer layers, the foam bonding to the inner faces of the two outer layers to form a mould unit comprising said grid embedded in the layer of injection moulded foam.

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